Monitoring Power Line Systems by Using Airborne Laser Range Data

(Some practical pre–experiment and it's future conception)

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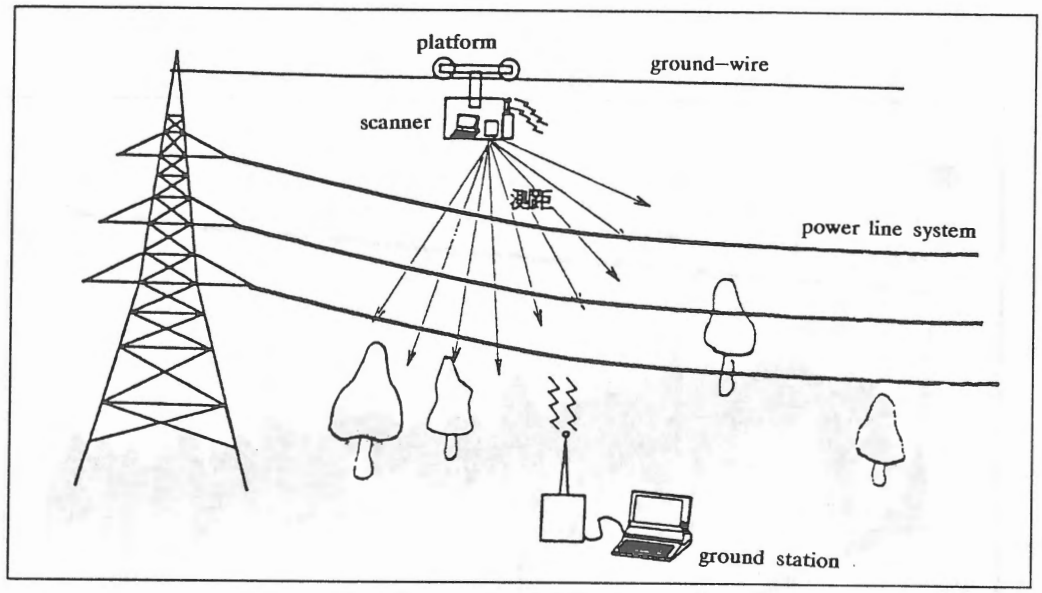
ABSTRACT

Over the passed few years, airborne laser ranging have been used for several applications as a new tool. In this paper, we report a result of pre–experiment of application for monitoring power line systems, and discussion about a set of the algorithms, handling and processing of airborne laser ranging data. The reason to execute the pre–experiment was to get an answer whether it is able to get information of ground surface under trees by using laser beam.

In this experiment, we have got 3D point data along power lines by using a scanning laser range finder which is implemented with 2kHz non–prism laser.

For monitoring power line systems with airborne laser ranger system, it is needed to measure the space position of power line and to recognize features of tree top under power line and to get ground surface profile. It is also needed to evaliate whether laser range equipment can measure ground surface under canopy of tree leaves and branches.These result and evaluation are presented in this paper.

After reporting our experiments, we will discuss data processing algorithm and future conceptions about airborne laser range data for another survey applications such as measuring urban buildings. Some examples are presented to show the efficiency of our approaches.



Fig–1 Conception of Pre–experiment

1.Itemes

To maintain power line systems in mountain area in Japan, it is important method to measure the distance between power line and the tree canopy. These distances have to be kept over suitable value under safety regulations. It is necessary to confirm that laser range equipments can measure the distance between power line and tree top.

It is obvious that a single laser shot rarely penetrate a leaf, but some shots may reach to the groud with many laser shots for a certain large area. In monitoring power line systems in Japan it is required not only to measure the the distance between power line and tree top, but also to detect ground surface information. That is the reason why we planned a pre–experiment of laser ranging on ground.

And as following approaches after the ground practice, we prepare and discuss a set of a algorithms for processing airborne laser profiling data of power line and for 3D objects reconstraction and recognition of vegetation and buildings.

2.Method

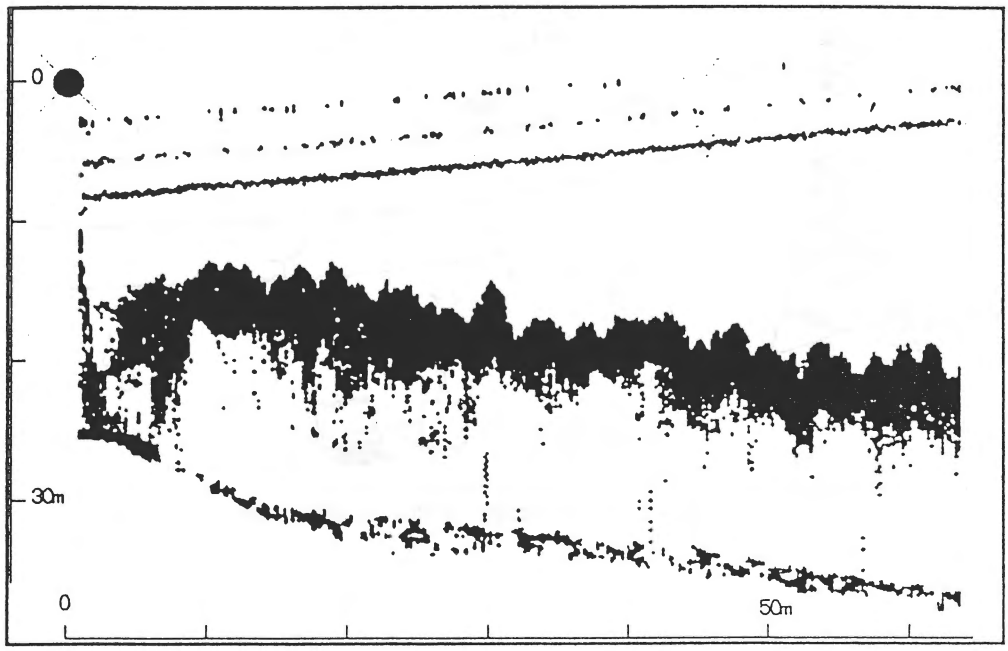
The basic principle of airborne laser profiling system is similar to non–prism laser ranger in measuring the distances. As pre–stage for airborne laser profiling, we performed a ground experiment using scanning laser ranger.

A platform moved along the ground wire, under this platform, a scanning laser range finder was suspended with the universal joint. Control of platform and scanning laser ranger were operated by wireless systems. Also, acquired data of scanning laser ranger was recieved by ground station also with wireless method.

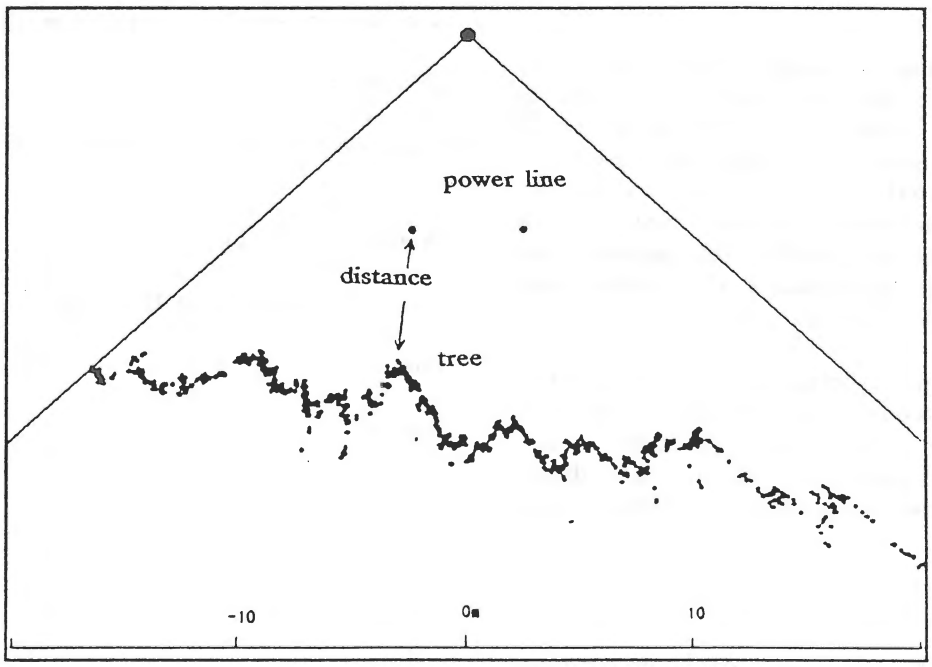
2–1.Platform

The specification of the platform are as follows.

Weight	25 kg
Size	W300 L790 H610 (in mm)
Power	12 V/DC
Speed	5.5 m/min
Controll	wireless



Fig–2. Verical section



Fig–3. Cross section

2–2.Scancing non–prism laser ranger (profiler)

The specification of the scanner are as follows.

Weight	11 kg
Size	W210, L510, H281 (in mm)
Pulse rate	2kHz
Scan rate	1.1Hz
Scan angle	50^{o}
Accuracy	$\pm$30cm
Limit of range	$<$ 150m
Contrall	wireless

3.Result

The result of this experiment are shows in Fig–2 and Fig–3. Fig–2 shows virtical section along power line, and Fig–3 shows cross–section along a scan. Dense Japanese cypress was planted under power line.

4.Conclusion

According to these results, we could have confirmation and prove that laser ranging can be applicable monitoring power line systems, And also we could have a good scope in using airborne laser range finder (profiler) for monitoring powerline at least. And also, we believe that airborne laser range finder (profiler) is available for other aerial survey applications.

5.Refereces

Y,TAKAHASHI.,1997.Advanced Study of Non–Prism Laser Ranger.In: OPTICAL 3D. Zurich,Switzerland